

NOTES ON SOME AUSTRALIAN POLYZOA.

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(Notes from the Australian Museum).

In the British Museum Catalogue of Marine Polyzoa, Part II. (1854), the late Mr. Busk, F.R.S., described two species of Polyzoa from the Philippine Islands, which he referred to the genus *Lunulites*, at the same time remarking that they were "curious forms and would appear to constitute a peculiar group." In the years 1879, '80, and '81 the Rev. J. E. Tenison-Woods, Mr. W. A. Haswell, and the Rev. T. Hincks published papers describing several species which are closely allied to those described by Mr. Busk. The various species have been assigned to four or five genera. I intend in this paper to show that the undermentioned species form a very distinct group having little in common with those with which they have usually been associated except habit or form:—

Lunulites Philippinensis, Busk.

„ *cancellata*, Busk.

Cupularia crassa, Tenison-Woods.

Conescharellina depressa, Haswell.

Lunulites angulopora, Tenison-Woods.

Conescharellina conica, Haswell.

Lunulites incisa, Hincks.

Eschara umbonata, Haswell.

Flabellopora elegans? d'Orb.

Mr. A. W. Waters in a paper on some fossil Polyzoa from New Zealand (Quart. Journ. Geol. Soc. Feb. 1887, p. 71), states that he had received recent specimens of the last-named species from N. S. Wales, "which is either *Lunulites cancellata*, Busk, or very closely allied to it."

The published descriptions and figures show that the species in the above list have not as yet been fairly understood, nor has the opercular-bearing aperture, or the very exceptional method of growth been fully described. Nearly all the figures representing zoöcial characters are the wrong side up, whilst the peristomial orifice has been described as the true oral aperture, and a special pore situated above the mouth has been mistaken for the sinus in the lower lip.

Mr. Woods figures the oral aperture in *Cupularia crassa* but he omits to mention details in his description. Mr. Waters (Quart. J. Geol. Soc. 1882), gives figures of *Lunulites cancellata* in which the oral aperture is shown, but these are also the wrong side up, and in his description he simply refers to it as a secondary orifice with a proximal sinus. It is in my opinion clear that he did at the time recognise the true significance of this "secondary orifice." Another prominent feature which is figured by Mr. Woods, and well-described by Mr. Haswell as "a narrow semi-lunar slit with the concavity directed outwards" has in most cases been overlooked, and its true import hitherto unnoticed.

The facts as to the actual structure of the species already mentioned have been derived from an attentive study of specimens in the collection of the Australian Museum, Mr. Woods's types in the Macleay Museum, and some lent to me by Mr. J. Brazier.

The structural features presented by the various species of this group are of such an exceptional character that it will be necessary to remove them altogether from the family *Selenariadæ* in which most of the species have been placed. In fact they appear to possess characters which are either unknown, or rarely found in other species of polyzoa; and possibly when they have been fully investigated they may form the nucleus of a new family.

The method of growth (not habit or form) or increase in size of the zoarium by the addition of new zoöcia is intercalary taking place on the surface between cells already formed, and not at the outer margin as in most other known Polyzoa. The only instances

of intercalary growth, as far as I have been able to ascertain, are recorded by Mr. Hincks, but in these cases it is confined to the ovicelliferous cells of *Schizoporella hyalina*, and *S. linearis*.

The formation of new zoëcia does not appear to be confined to any particular part, but may take place at any point between the centre and the margin; when near the latter the zoëcium is formed in the space intervening between two, and when nearest to the former in the intervening space bounded by four zoëcia. The direction of the zoëcia is also apparently reversed, from the fact that the free distal edge of the operculum is nearest to and directed towards the apex in those of a conical form, and to the apparent base in those which are flattened; while the hinged end or proximal is nearest to the outer margin of the zoarium.

The manner in which the peristomial orifice is formed appears to be just the opposite to what obtains in other peristomiate Polyzoa, and there is a special feature of an important character which, if not new to the class is exceedingly rare, and so far I have searched in vain for the record of a similar structural element.

The first indication of the formation of a new zoëcium appears on the upper surface of the zoarium as an elevated or depressed round spot bordered on one side by a thin layer of epitheca. At this point the "semilunar slit with the concavity directed outwards" is formed, and by the gradual extension of this slit to a circular form a piece of the calcareous lamina is cut out, the resulting opening being that of the peristome, and at a short distance below the true oral aperture is seen to be also in a fully formed condition. It is the rule to speak of the opercular-bearing aperture as the primary, and of the peristomial as the secondary orifice; but in this case it appears doubtful which ought to rank as primary or secondary.

In a median line above the mouth close to or upon the margin of the peristome there is a circular or subcircular pore usually covered by a membrane. It is this pore, when in an imperfect or broken state, that has been mistaken for the proximal sinus in the lower lip of the oral aperture; but the true oral sinus is much wider, and at the opposite end of the mouth to that of the pore.

The shape of the oral aperture generally approaches that of *Cellepora eatonensis* as figured by Busk in the "Challenger" Polyzoa, Pl. XXIX., fig. 5b, but the sinus varies in width so much that in some cases the aperture might be described as oval with two lateral denticles at the base.

It is evident that the seven species already enumerated are closely allied to each other, and can no longer remain in the various genera to which they have been referred. They do not belong either to the genus *Lunulites* or to *Cupularia*; and the genus *Conescharellina* as at present defined would not admit them; the same may also be said of *Flabellopora*. Mr. A. W. Waters in referring to *Lunulites incisa* H. says it "is a species of the *Schizoporellidae*." Nevertheless to whatever family they may ultimately prove to be related, at present I venture to make a new genus for their reception.

BIPORA, n. g.

Zoarium uni-or bilaminate, conical, or forming lobate or flabellate expansions; growth intercalary; zoecia immersed, erect, side by side, with their bases resting on a cancellated lamina, forming alternating rows directed to the primary part of the zoarium; oral aperture with a well-marked sinus in the lower lip. A special pore above the mouth; peristomial orifice formed by the gradual extension of a narrow slit and the removal of a portion of the calcareous lamina. Oecia external, globose.

(1.) BIPORA CANCELLATA, Busk.

Lunulites cancellata, Busk, Brit. Mus. Cat. Polyz. 1854, Part II, p. 101, pl. CXIII, figs. 4-5-6-7.

Zoarium conical, plane or slightly convex beneath; zoecial apertures rounded above, with a distinct sinus below; peristome elevated above, depressed below, with a circular pore on its upper border; an avicularium on each side of the mouth, with a sub-circular mandibular space.

I have examined several fossil examples of this species which appear to agree with Busk's description and figures, and which may be identical with the form figured as *L. cancellata*, Busk, by Mr. Waters in his paper on Fossil Bryozoa from Bairnsdale, but, both in this species and in the next, the identity can only be definitely settled by comparison with the types.

Loc.—(living) Philippine Islands; (fossil) Muddy Creek, Victoria.

(2.) *B. PHILIPPINENSIS*, Busk.

Lunulites Philippinensis, Busk, *op. cit.* Part II, p. 101, pl. CXIII, figs. 1-2-3.

Zoarium depressed, conical, plane or convex beneath, usually about $\frac{1}{8}$ of an inch in diameter; zoecial orifice elongate, rounded above, and with a wide rounded sinus below; operculum oval; peristomial orifice ovate, the margin produced above at the sides then suddenly depressed below, with a subcircular pore on the upper border; an avicularium with a subcircular mandible on each side and sometimes one in front below the mouth, a number of similar avicularia on the under surface of the zoarium, some on rounded elevations and others in circular depressions. Oœcia external, globose, smooth, with a faint fimbriated stigma in front.

Loc.—Port Jackson.

This species is frequently to be met with in some parts of Port Jackson, and I have examined a fair number of specimens. The surface of the zoarium is covered with a thin yellowish epitheca; and the semilunar slits which indicate the growth of new zoecia are to be seen in all stages of development, especially in the young. It is by a careful examination of this species that I have been enabled to work out the structure of the others. The zoarium, when seen in longitudinal section shows the concave side as having a cancellated layer of varying thickness, from which the zoecia take their origin; each zoecium is narrowed at the base and very slightly bent inwards; its direction from this point is outwards, with a gentle curve upwards, at nearly right angles to the cancellate layer.

When the zoecia are seen in transverse section the outline of each zoecium is irregularly pentagonal.

The anterior pore, when seen from within, appears as a flask-shaped projection on the cell-wall, and is about as long as the shorter diameter of the mouth; in some there appears to be an opening, and in others the base is well rounded without any opening; it may possibly be the retreat of a protrusible sensitive organ, but in no case have I seen anything at the upper extremity which would indicate the presence of an external vibracular organ. The cancellate structure, which exists more or less in all the species, may originate by the lower portion of the zoecia being continually partitioned off as the zoarium increases in size.

In some of the specimens lent by Mr. Brazier the oecia are fairly abundant, but, except the zoarium is broken into two halves or set on its edge, the orifice cannot be seen. From this fact it will be evident that they are in the usual position above the mouth, and nearest to the primary part of the zoarium.

(3.) *B. DEPRESSA*, Haswell.

Conescharellina depressa, Hasw. Proc. Linn. Soc. N.S.W. 1880, Part I, Vol. V, p. 41, pl. III, fig. 4.

Zoarium biconvex, slightly flattened beneath; oral aperture elongate, rounded above, with a sinus below, about half the diameter of the mouth; or ovate with a sub-triangular denticle on each side near the base. Operculum ovate with a very slightly thickened border and two circular spots on the upper half; peristome much elevated above, and on each side to below the mouth, then suddenly depressed; an avicularium with an elongate triangular mandible situated on a low elevation on one side of the mouth.

“Under surface of zoarium perforated by close-set circular pores, each occupied, either at the surface or at a varying depth, by a thin translucent covering perforated by several minute porules, usually with a rather larger one in the centre.”

Loc.—Port Denison.

I have only seen some 5 or 6 specimens of this species, all of which are immature, and probably when obtained in the adult state the zoarium will be found to be concave beneath. I have seen one specimen in which the base is concave, but it is too imperfect to be certain as to its identity. The figure given by Mr. Haswell is upside down, but the outlines of the peristomial orifices are correct. The outer row of zoecia are very prominent, and without avicularia.

(4.) *B. CRASSA*, Tenison-Woods.

Lunulites (Cupularia) crassa, Ten.-Woods, Trans. Phil. Soc. Adelaide, 1879-80, p. 5, pl. I, figs. 1a, 1b, 1c.

I have examined the type specimens in the Macleay Museum, which resemble the last species in the peristomial characters, the margin being produced, and very much thickened at the sides, hiding to a great extent the oral aperture, which lies in a depression below.

The avicularia however have a subcircular mandible, and the pore over the mouth is large. I have no doubt of its being a good species. Mr. Waters when speaking of the plates which accompany Mr. Woods's paper mentions the fact that the whole of the species figured are the wrong side up, which is certainly true of all the species except two; but even these were intended to represent the same aspect as the others. The figure of *B. crassa* is after all the right side up, and gives an accurate view of the oral aperture with the special pore above. It is also probably the first published figure which exhibits the form of the true opercular-bearing aperture.

I have no doubt Mr. Woods saw the important structural difference between this species and those belonging to the *Selenariade*.

Loc.—Off Cape Three Points, and Port Stephens (70 to 80 fathoms).

(5.) *B. ANGULOPORA*, Tenison-Woods.

Lunulites angulopora, Ten.-Woods, *op. cit.*, p. 7, pl. I, fig. 3a-3c; *Conescharellina conica*, Hasw. Proc. Linn. Soc. N.S.W.,

1880, Vol. V. Part I, p. 42, pl. III, figs. 7-8; *Lunulites incisa*, Hincks, Ann. & Mag. Nat. Hist. 1881, Vol. VIII, 5 series, p. 127, pl. IV. figs. 1-3.

Zoarium conical, plane or slightly concave beneath; zoœcia in alternating rows, sometimes with an incomplete row of four or five cells near the base; oral aperture immersed, rounded above and a sinus below which is about $\frac{1}{3}$ the diameter of the mouth; operculum ovate, constricted (?) near the base, with two circular spots on the upper half; peristome elevated on each side, depressed below the mouth, orifice ovate with a pore on the upper margin; avicularia forming elevated rows between the zoœcial orifices, mandibles triangular with an acute point; under surface of zoarium when perfect covered by a calcareous lamina, with a number of avicularia some on elevations and others in circular depressions; on the summit of the zoarium there is usually a cluster of irregular avicularia bearing cells with long acute mandibles.

Loc.—Holborn Island, Port Stephens, and Bass's Straits.

The question of priority in this species is I think in Mr. Woods's favour. His paper was read in September 1879, and would probably be published early in 1880. Mr. Haswell's was read in January 1880, and would probably be issued in April or March, while that of Mr. Hincks did not appear until August 1881.

The figures of the zoœcia given by Mr. Haswell, and those also of Mr. Hincks, are, I think, upside down, judging from the shading and the very narrow sinus shown, but which is really more like the pore above the mouth than the true oral sinus; the latter is in perfect specimens about $\frac{1}{3}$ the diameter of the mouth. The zoœcial apertures in Mr. Woods's figure are badly drawn; still it is the right side up, and shows a correct view of a "semilunar slit with the concavity directed outwards," and an avicularium below pointing downwards. It will also be interesting to note that it is on the elevated ridge which carries the avicularia; and further it shows the intercalary method of growth, as well as the formation of an incomplete row of zoœcia. Altogether this figure gives the general features of what really takes place in the species.

The slit which indicates the formation of a new cell invariably has an avicularium below, with the mandible pointing downward at first, but as growth goes on this is usually forced to one side of the mouth, though occasionally it remains in front.

(6.) B. UMBONATA, Haswell.

Eschara umbonata, Haswell, *op. cit.*, p. 41, pl. II, figs. 5-6.

Zoarium free, bilaminar, flat, simple or forming trilobate expansions, "surface ornamented with numerous rounded knobs of various sizes," zoecia immersed, directed towards (what appears to be the base) the primary part of the zoarium. Oral aperture rounded above, and a wide sinus below; peristomial orifice nearly round, margin slightly elevated, with a subcircular pore on the upper border; an avicularium on each side of the mouth, frequently a third one in front, mandible triangular generally pointing upwards.

Loc.—Holborn Island, (20 fathoms).

There are three specimens in the collection of the Australian Museum, one a flat piece $\frac{1}{4}$ of an inch by $\frac{1}{8}$ of an inch: the other two have each three lobes; the central one in the larger specimen is $\frac{5}{16}$ from base to summit, and the lateral lobes $\frac{1}{8}$ of an inch in length, and nearly as wide; all the lobes taper a little outwards. The "semilunar slit" is not seen in any of the specimens, but the peristomial opening is, I believe, formed in the same manner as in the others; several of the zoecial openings are closed by a calcareous plate, and have the appearance of young zoecia; the plate is seen to be thinner at the margin; probably the slit-like opening is not formed.

Mr. Haswell's description of the mouth of this species clearly shows that it was the anterior pore which he mentions as the sinus in the lower lip. He says "mouth varying in form, the lower lip sometimes straight, sometimes with a small sinus, sometimes with a rounded central lobe." This exactly describes the appearance of the anterior oral pore in various stages of perfection. The peristomial orifice with the pore broken down closely resembles the

figure given on pl. 45, fig. 3, in Hincks's "Brit. Marine Polyzoa," of *Schizoporella hyalina*, and it was only after repeated examination that I saw the true oral aperture, owing to a belief that the pore and the opening represented it. Although the true aperture is not deeply immersed, it is difficult to see at first on account of the peristome obstructing the view, but when once seen it presents a well formed sinus in the lower lip at the opposite end of the mouth to that of the pore. It is from the apparent double character of the mouth that the name *Bipora* is given to the genus.

(7.) BIPORA (?) ELEGANS.

Flabellopora elegans, d'Orb., Waters, Quart. J. Geol. Soc. Feb. 1887, p. 71.

Zoarium free, bilaminar, flabelliform in large examples, $\frac{1}{2}$ an inch wide by $\frac{3}{8}$ of an inch deep, with a projecting nodule in the centre on the concave side; zoecia wholly immersed, erect, side by side, their bases separated by a thin cancellated layer, forming alternate rows, and directed towards the projecting nodule; oral aperture rounded above, with a rather wide sinus below; peristome slightly higher above the mouth than below; orifice nearly round with a median pore above, a depressed avicularium on each side, usually below the mouth, occasionally another in front; mandibles subcircular pointing upwards and outwards, a number of irregular avicularian cells on the nodular projection similar to those on *B. angulopora*.

Loc.—Port Jackson.

If this species should prove to be different (as I think it will) from the fossil form described by d'Orbigny as *Flabellopora elegans*, it can remain as *B. elegans*, Waters. D'Orbigny's figure (Palæont. Franç. Bryoz. Tom. V. pl. 661) certainly resembles the recent form. The same may be said of *B. umbonata*, which comes nearest to d'Orbigny's species; if it were not for the elevated nodules, the last-named might pass for the fossil species. I have examined about nine specimens in all, two of them being less than $\frac{1}{2}$ of an inch in their greatest diameter, which when placed on their convex edges and

viewed from above greatly resemble *B. angulopora*, and if a little less compressed might be mistaken for that species at first sight. The avicularian cells are present in both specimens on the nodular projection, and the simular slits on various parts of the zoarium. The slits can be seen even in very old specimens scattered about on the surface. It is not difficult to trace the stages by which the conical form might be changed into the flabellate, and afterwards into the lobate form, and which has probably taken place. If we imagine the internal cancellated layer to become less developed, accompanied by a gradual compression, and the addition of a few more rows of zoecia towards the outer margin, we can easily see that we should have a form like *B. elegans*, which is in reality only a flattened cone with the base widely extended, and in *B. umbonata* the flabellate form is changed into a lobate one by the non-development of a portion of the colony. So that the broad non-divided end of the last-named species and the nodular portion of the former correspond with the apex of the cone.

Postscript.—Since the foregoing was written I have been fortunate in obtaining some living examples of *Bipora Philippinensis*, Busk, which I have had under observation for three days. Nearly every specimen possesses a pair of tubular filaments inserted on each side of the zoarium, about mid-way between the margin and the summit on the upper surface; each tube is about $\frac{1}{2}$ an inch long, and in some cases attached to the tubes of an annelid, and in others to fragments of shell. Some of the specimens have begun to form new attachment tubes which are about three times the height of the oecia. Each tube is seen to be lined with a layer of sarcode similar to that seen in the growing offshoots in *Victorella pavidus*, S. Kent, consisting of granular and fisiform bodies which form a kind of net-work. The tube appears to grow out of an avicularium either at the side or in front of the zoecial orifice. After repeatedly counting the number of tentacles, I find that they vary from 13 to 15. The pore above the mouth is covered by a membrane, and the marginal row of zoecia have the peristome produced below into an acute triangular hyaline point.